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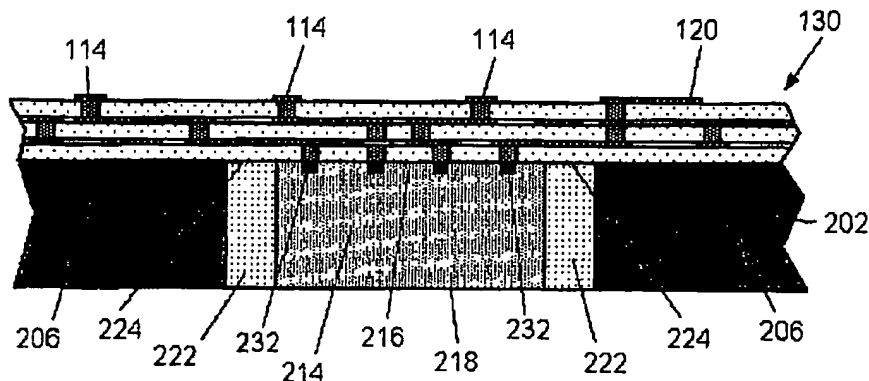
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MICROELECTRONIC PACKAGE HAVING BUMPLESS LAMINATED INTERCONNECTION LAYER



(57) Abstract: A microelectronic device fabrication technology that places at least one microelectronic die within at least one opening in a microelectronic package core and secures the microelectronic die/dice within the openings(s) with an encapsulation material, that encapsulates at least one microelectronic die within an encapsulation material without a microelectronic package core, or that secures at least one microelectronic die within at least one opening in a heat spreader. A laminated interconnector of dielectric materials and conductive traces is then attached to the microelectronic die/dice and at least one of following: the encapsulation material, the microelectronic package core, and the heat spreader, to form a microelectronic device.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/44968

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L23/538 H01L23/36 H01L23/498 H01L21/68 H01L21/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5 497 033 A (FILLION RAYMOND A ET AL) 5 March 1996 (1996-03-05) the whole document	1,2,4, 11,13 3,5,9, 10,12, 14,15
X Y	EP 0 110 285 A (PRUTEC LTD) 13 June 1984 (1984-06-13) page 5, line 18-24; figure 2	6-8 14,15
Y	US 5 384 955 A (GREMBAN BRADLEY S ET AL) 31 January 1995 (1995-01-31) column 2, line 57-59; figure 1F column 3, line 51-53 column 4, line 24-26	3,5,9, 10,12
-/-		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the International filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the International filing date but later than the priority date claimed

"T" later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the International search

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 01/44968

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 572 849 A (THOMSON CSF) 9 May 1986 (1986-05-09) the whole document	1
Y	US 5 409 865 A (KARNEZOS MARCOS) 25 April 1995 (1995-04-25)	16-26
Y	figure 1	16
Y	column 4, line 65FF	19
Y	column 5, line 1	20
Y	column 4, line 65	24
Y	column 5, line 1	25
Y	US 6 154 366 A (LI JIAN ET AL) 28 November 2000 (2000-11-28)	16-21
Y	figures 2J,3I	17,18
Y	PHAM A ET AL: "DEVELOPMENT OF A MILLIMETER-WAVE SYSTEM-ON-A-PACKAGE UTILIZING MCM INTEGRATION" IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, IEEE INC. NEW YORK, US, vol. 49, no. 10, October 2001 (2001-10), pages 1747-1749, XP001108270 ISSN: 0018-9480 figure 1	21
Y	US 5 745 984 A (COLE JR HERBERT STANLEY ET AL) 5 May 1998 (1998-05-05)	22,24,25
Y	column 4, line 35-40	22
A	US 3 903 590 A (YOKOGAWA SYUNZI) 9 September 1975 (1975-09-09) the whole document	16
A	US 5 359 496 A (KORNRUMPF WILLIAM P ET AL) 25 October 1994 (1994-10-25) the whole document	
Y	US 5 013 871 A (MAHULIKAR DEEPAK ET AL) 7 May 1991 (1991-05-07)	23,25,26
Y	column 1, line 35	23
Y	column 1, line 35	25
Y	column 1, line 30	26
A	EP 0 579 438 A (AMERICAN TELEPHONE & TELEGRAPH) 19 January 1994 (1994-01-19) the whole document	27
A	EP 0 246 447 A (IBM) 25 November 1987 (1987-11-25) the whole document	28

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/44968

Box I. Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II. Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-15

A method of forming a microelectronic package by encapsulating one or several microelectronic die(s) with an encapsulation material and contacting the dies by a laminated interconnect layer.

2. Claims: 16-31

A method of soldering one or several microelectronic die(s) to a heat sink.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/44968

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5497033	A	05-03-1996	US 5353498 A DE 69430765 D1 DE 69430765 T2 EP 0611129 A2 JP 7007134 A	11-10-1994 18-07-2002 23-01-2003 17-08-1994 10-01-1995
EP 0110285	A	13-06-1984	EP 0110285 A2 GB 2130794 A JP 59171130 A	13-06-1984 06-06-1984 27-09-1984
US 5384955	A	31-01-1995	US 5386627 A US 5404044 A	07-02-1995 04-04-1995
FR 2572849	A	09-05-1986	FR 2572849 A1	09-05-1986
US 5409865	A	25-04-1995	EP 0718882 A1 US 5397921 A	26-06-1996 14-03-1995
US 6154366	A	28-11-2000	NONE	
US 5745984	A	05-05-1998	US 6294741 B1	25-09-2001
US 3903590	A	09-09-1975	CA 994004 A1 DE 2411259 A1 FR 2220879 A1 GB 1426539 A	27-07-1976 19-09-1974 04-10-1974 03-03-1976
US 5359496	A	25-10-1994	EP 0435530 A2 JP 3211757 A	03-07-1991 17-09-1991
US 5013871	A	07-05-1991	US 4897508 A EP 0421005 A2 HK 1008112 A1	30-01-1990 10-04-1991 30-04-1999
EP 0579438	A	19-01-1994	US 5249733 A EP 0579438 A2 JP 2813109 B2 JP 6163869 A	05-10-1993 19-01-1994 22-10-1998 10-06-1994
EP 0246447	A	25-11-1987	DE 3775980 D1 EP 0246447 A2 JP 1638544 C JP 3001830 B JP 62263645 A US 4908689 A	27-02-1992 25-11-1987 31-01-1992 11-01-1991 16-11-1987 13-03-1990